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EXAMINER

MUTSCHLER, BRIAN L

ART UNIT	PAPER NUMBER
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1753

DATE MAILED: 10/25/2002

12

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application N .

09/855,059

Applicant(s)

BASOL ET AL.

Examiner

Brian L. Mutschler

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 October 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-62 is/are pending in the application.
- 4a) Of the above claim(s) 46-56 and 62 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4-12,14-25,27-45 and 57-61 is/are rejected.
- 7) ☒ Claim(s) 3,13 and 26 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 September 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>2 & 5-7</u> . | 6) <input type="checkbox"/> Other: |

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Group I, claims 1-45 and 57-61, in Paper No. 11 is acknowledged.

Drawings

2. The drawings are objected to because the reference sign "t₃" in Figure 1E should be changed to --t₅-- (see line 3 of par. [0010] on page 5). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

3. The disclosure is objected to because of the following informalities:
 - a. In line 17 of paragraph [0056], please change "115" to --115a--; and
 - b. In line 20 of paragraph [0056], please change "115a" to --115b--.Appropriate correction is required.
4. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: APPARATUS FOR CONTROLLING
THICKNESS UNIFORMITY OF ELECTROPLATED AND ELETROETCHED LAYERS.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 7-45 and 57-61 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 7 recites the limitation "An anode assembly useable together with a cathode assembly in a device which can provide deposition of conductive material..." in lines 1-3. The claim further recites the limitations "an anode which can be contacted by the electrolyte..." in line 5 and "a rate...can be varied" in lines 12-13. These limitations are indefinite because they do not positively recite that which is being claimed. The terms "usable" and "can" imply that the anode is capable of being used with the anode to perform the stated function, but does not explicitly define the structure of the claimed device. It is suggested that the limitations be changed to "An anode assembly and cathode assembly in a device for providing deposition of conductive material...", "an anode contacted by the electrolyte..." and "a rate...is varied", respectively. The same applies to dependent claims 8-20.

Claim 12 recites the limitation "the electrically isolated sections can be connected" in line 1-2. This limitation does not positively recite the structure. It is suggested that the phrase be changed to "the electrically isolated sections are connected".

Claim 20 recites the limitations “An apparatus which can control thickness uniformity” in line 1, “an anode which can be contacted by the electrolyte” in line 4, “a rate...can be varied” in line 14, and “a power source which can provide a potential” in line 15. These limitations are indefinite because they do not positively recite the structure of the apparatus being claimed. It is suggested that the phrases be changed to “An apparatus for controlling thickness uniformity”, “an anode contacted by the electrolyte”, “a rate...is varied”, and “a power source which provides a potential”, respectively. The same applies to dependent claims 21-45.

Claim 25 recites the limitation “the electrically isolated sections can be connected” in lines 1-2. This limitation is indefinite because it does not positively recite the structure of the device. It is suggested that the phrase be changed to “the electrically isolated sections are connected”.

Claim 33 recites the limitation “at least one control power source which can supply a voltage” in lines 1-2. This limitation is indefinite because it does not positively recite the structure of the device. It is suggested that the phrase be changed to “at least one control power source which supplies a voltage”. The same applies to dependent claims 34 and 35.

Claims 34, 35, 37, 38, 41, 42, 44 and 45 are indefinite because they do not further limit the structure of the apparatus. The limitations provided in the claims pertain to the rate of deposition and do not provide additional structural limitations to the claims from which they depend.

Claim 36 recites the limitation "said power source can additionally supply a voltage" in lines 1-2. This limitation is indefinite because it does not positively recite the structure of the claimed device. It is suggested that the phrase be changed to "said power source additionally supplies a voltage". The same applies to dependent claims 37 and 38.

Claim 39 recites the limitation "at least on additional power source which can supply an additional voltage" in lines 1-3. This limitation is indefinite because it does not positively recite the structure of the device. It is suggested that the phrase be changed to "at least one additional power source which supplies an additional voltage". The same applies to dependent claims 41 and 42.

Claim 40 recites the limitation "at least one control power source which can supply a voltage" in lines 1-2. This limitation is indefinite because it does not positively recite the structure of the claimed device. It is suggested that the phrase be changed to "at least one power control source which supplies a voltage".

Claim 43 recites the limitation "said power source can supply a voltage" in lines 1-2. This limitation is indefinite because it does not positively recite the structure of the claimed device. It is suggested that the phrase be changed to "said power source supplies a voltage". The same applies to dependent claims 44 and 45.

Claim 57 recites the limitations "An apparatus which can control thickness uniformity" in line 1, "an anode which can be contacted by an electrolyte" in line 4, "a rate...can be varied" in lines 13-14, and "a power source which can provide a potential" in line 15. These limitations are indefinite because they do not positively define the

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structure of the apparatus. It is suggested that the phrases be changed to "An apparatus for controlling thickness uniformity", "an anode contacted by an electrolyte", "a rate...is varied", and "a power source which provides a potential", respectively. The same applies to dependent claims 58-61.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1, 4-9, 11, 12, 14 and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Galik (U.S. Pat. No. 4,678,545).

Regarding claims 1 and 7, Galik discloses an apparatus for electroplating a circuit board comprising anodes **44** contacting the electrolyte **36** (fig. 8). The circuit board has a mask with a plurality of openings defining the areas to be plated (col. 2, lines 23-49). Conductive mesh screens **46** are positioned between the anodes **44** and wafer **32** (fig. 8; col. 5, lines 35-44). The screens **46** are connected to a power source (fig. 8).

Regarding claims 4 and 9, the conductive mesh screens **46** are shown having two areas electrically isolated from one another (fig. 8).

Regarding claims 5, 6 and 12, the power to each screen **46** is separately regulated and variable (fig. 8; col. 6, lines 18-52).

Regarding claim 8, the conductive element is a conductive mesh screen **46** (col. 5, lines 35-44).

Regarding claim 11, the screens **46** are separated by a gap (fig. 8).

Regarding claim 14, the screens **46** are positioned between the anodes **44** and the wafer **32** (fig. 8).

Regarding claim 19, the screens **46** are in the shape of strips (fig. 6; col. 5, lines 35-44).

Since Galik teaches the limitations recited in the instant claims, the reference is deemed to be anticipatory.

9. Claims 7-11 and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Geels (U.S. Pat. No. 4,643,816).

Regarding claim 7, Geels discloses a plating apparatus comprising anodes **16**, **16'** contacting the electrolyte **14** (fig. 1). A shroud (mask) **20** having openings is disposed between the workpiece to be plated **18** and the anodes **16**, **16'** (fig. 1). Conductive elements **35**, **35'** are disposed at the ends of the shroud **20** (fig. 1; col. 3, lines 39-57).

Regarding claim 8, the conductive elements **35**, **35'** comprise screens of electrically conductive material (col. 3, lines 46-50).

Regarding claim 9, Geels discloses a plurality of electrically isolated screens **35**, **35'** (fig. 1).

Regarding claim 10, the screens **35, 35'** are separated by the electrically isolating shroud, which is made of a non-conductive material (col. 3, lines 32-33).

Regarding claim 11, a gap separates the screens **35, 35'** (fig. 1).

Regarding claim 19, the screens **35, 35'** are in the form of strips (fig. 1).

Since Geels teaches the limitations recited in the instant claims, the reference is deemed to be anticipatory.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 1, 4-12, 19-25, 27, 32-45 and 57-61 rejected under 35 U.S.C. 103(a) as being unpatentable over Stone (U.S. Pat. No. 6,132,583) in view of Edelstein (U.S. Pat. No. 6,106,687).

Regarding claims 1, 7, 8, 20, 21, 27, 57 and 58, Stone discloses an apparatus for plating wafers comprising a plurality of anodes **22A, 22B** contacting the electrolyte **21** (fig. 2). Between the wafer **26** and the anodes **22A, 22B**, shields are disposed (fig. 2). In one embodiment, the shield is a conductive mesh **40** connected to a power supply in

such a way that the output is variable (fig. 2; col. 6, lines 35-62). The cathode assembly **26** is movable (col. 5, lines 23-27).

Regarding claims 4, 9, 22 and 59, Stone teaches that the two shields may be any of the disclosed shields, such as two of the conductive mesh shields (col. 5, lines 61-65).

Regarding claims 5, 6, 12, 25, 33, 36, 39, 40 and 43, each screen **40** is charged with a voltage by a voltage source (col. 6, lines 45-54). According to Stone, "the applied voltage magnitude is variable...and the power may be provided from any voltage source" (col. 6, lines 55-62).

Regarding claims 10, 23 and 60, the frames **52** containing the charged screens **40** are attached to a glide bar **32** (col. 6, lines 35-44). Since only the screens **40** are charged, it would be inherent that either the frame **52** or other supporting member would be electrically isolating.

Regarding claims 11, 24 and 61, the two shields are separated by a gap (fig. 2).

Regarding claims 19 and 32, the screens **40** have the form of strips (fig. 5).

Regarding claims 34, 35, 37, 38, 41, 42, 44 and 45, Stone discloses that the charged screens **40** can either accelerate or decelerate the flow of ions (col. 7, lines 7-26).

The plating apparatus disclosed by Stone differs from the instant invention because Stone does not disclose the following:

- a. A mask with openings, as recited in claims 1, 7, 20 and 57; and

- b. The power sources and additional power sources, as recited in claims 5, 6, 12, 25, 33, 36, 39, 40 and 43.

Regarding claims 1, 7, 20 and 57, Edelstein discloses a baffle to modulate the cross-sectional distribution of flow rate in electrodeposition apparatuses. The baffle (mask) is comprised of two non-conducting plates **10, 12** having a plurality of holes **14, 16** that control the cross-sectional flow of the electrolyte by rotating the plates **10, 12** in relation to one another (fig. 1 and 3A-3C). Controlling the cross-sectional flow distribution of the electrolyte allows for the cross-sectional thickness of the deposited layer to be controlled according to the placement and orientation of the holes (fig. 8, 10 and 12).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the shield in the plating apparatus of Stone to use a baffle as taught by Edelstein because the baffle allows the cross-sectional flow distribution of the electrolyte to be controlled, which regulates the cross-sectional thickness of the deposited layer.

Regarding claims 5, 6, 12, 25, 33, 36, 39, 40 and 43, Stone discloses, "the power may be provided from any voltage source" (col. 6, lines 55-62). It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the power source of Stone to use separate power sources or common power sources because Stone teaches that "any voltage source" can be used and the selection of a power source is dependent on the desired result of the system.

Regarding the intended use of the apparatus, i.e., electrodepositing or electroetching, the same apparatus can be used for both processes. To switch from electrodepositing to electroetching, the polarity of the cathode and anode is switched.

12. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Stone (U.S. Pat. No. 6,132,583) in view of Edelstein (U.S. Pat. No. 6,106,687), as applied above to 1, 4-12, 19-25, 27, 32-45 and 57-61, and further in view of Geels (U.S. Pat. No. 4,643,816).

Stone and Edelstein describe a plating apparatus having the limitations recited in claims 1, 4-12, 19-25, 27, 32-45 and 57-61 ^{Def} of the instant invention, as explained above in section 11.

The apparatus described by Stone and Edelstein differs from the instant invention because they do not disclose the conductive mesh attached to the surface of the mask.

Geels discloses a plating apparatus comprising a shroud (mask) **20** having conductive elements **35, 35'** disposed at the ends of the shroud **20** (fig. 1; col. 3, lines 39-57). The conductive elements **35, 35'** comprise screens of electrically conductive material (col. 3, lines 46-50). The screens **35, 35'** are attached at the end of the shroud **20** to "[provide] a surface over which the electrical potential is substantially uniform, making the potential difference between points on the cathode-workpiece and points on

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the [screen] as uniform as possible" making the current more uniform (col. 3, lines 50-57).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the conductive mesh in the apparatus described by Stone and Edelstein to affix the conductive mesh directly to the mask as taught by Geels because affixing the mesh directly to the mask provides a more uniform potential, resulting in a more uniform coating.

13. Claims 15-18 and 28-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stone (U.S. Pat. No. 6,132,583) in view of Edelstein (U.S. Pat. No. 6,106,687), as applied above to 1, 4-12, 19-25, 27, 32-45 and 57-61, and further in view of Tzanavaras et al. (U.S. Pat. No. 5,421,987), Uzoh (U.S. Pat. No. 6,071,388) and Hanson et al. (U.S. Pat. No. 6,139,703).

Stone and Edelstein describe a plating apparatus having the limitations recited in claims 1, 4-12, 19-25, 27, 32-45 and 57-61 of the instant invention, as explained above in section 11.

The apparatus described by Stone and Edelstein differs from the instant invention because they do not disclose the following:

- a. One of the isolated sections of the conductive element circumferentially surrounds another of the electrically isolated sections, as recited in claims 15 and 28;

- b. The electrically isolated sections of the conductive element are irregularly shaped, as recited in claims 16 and 29;
- c. One of the electrically isolated sections of the conductive element is ring-shaped, as recited in claims 17 and 30; and
- d. The other of the electrically isolated sections is disc-shaped, as recited in claims 18 and 31.

Regarding claims 15-18 and 28-31, Tzanavaras et al. disclose a plating apparatus comprising bias rings **40** and collimating screens (masks) **34** to control the thickness and uniformity of the deposited layer (col. 5, line 46 to col. 6, line 2; col. 6, lines 52-62). The bias rings **40** are designed to “divert excessive current density away from [the edges and corners of the substrate]” (col. 5, lines 61-67). For square substrates **42**, bias ring **40A** has an irregular shape; for circular substrates **42**, bias ring **40B** is ring-shaped (fig. 2(a) and 2(b)).

Uzoh teaches the use of similar rings **40** that act as auxiliary electrodes to control the deposition around the edges of the workpiece **16** (col. 5, lines 23-45). The auxiliary electrodes **40** are made of conductive mesh and can be placed coplanar with the workpiece **16** (as shown in Tzanavaras et al.) or the auxiliary electrode **40** may be “non-coplanar as may be required for a particular electroplating operation” (col. 6, lines 48-63).

Hanson et al. teach the use of a plurality of auxiliary electrodes **130**, wherein each segment **130** has a separately controlled voltage to control the deposited layer (fig. 2; col. 4, lines 3-27). Having a plurality of individually controllable segments allows the deposition to be more precisely controlled.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the conductive mesh screen in the apparatus described by Stone and Edelstein to use a bias ring or auxiliary electrode as taught by Tzanavaras et al. and Uzoh because the bias ring/auxiliary electrode enables excess current to be diverted away from the edges and corners of the substrates for different sized substrates. Furthermore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have used a mesh screen as taught by Uzoh because using mesh allows the auxiliary electrode to be positioned coplanar or non-coplanar to the substrate because the mesh permits the flow of electrolyte through its openings.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the conductive elements in the apparatus described by Stone and Edelstein to be irregularly shaped, ring-shaped or disc-shaped as disclosed by Tzanavaras et al. because Tzanavaras et al. teach that the shape of the bias ring should be designed such that the current density is uniform for the substrate, which requires irregular shapes for polygon-shaped substrates and disc or ring shapes for circular and rounded substrates.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the conductive elements in the apparatus described by Stone and Edelstein to use a conductive element comprised of a plurality of cooperative segments as taught by Hanson et al. because a greater number of individually controlled segments allows more precise control of the current density.

Allowable Subject Matter

14. Claims 3, 13 and 26 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

15. The following is a statement of reasons for the indication of allowable subject matter: The prior art of record does not teach or suggest the formation of a conductive mesh sandwiched by two mask layers. This feature of the instant invention allows the current density to be controlled by a single controlling member. The prior art, e.g., Galik (U.S. Pat. No. 4,678,545), discloses separate masks and conductive elements.


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian L. Mutschler whose telephone number is (703) 305-0180. The examiner can normally be reached on Monday-Friday from 8:00am to 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (703) 308-3322. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

blm
October 23, 2002


NAM NGUYEN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700